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The Allocation of Personnel to Military Occupational Specialties

Edward Schmitz and Abraham Nelson

Manpower and Personnel Policy Research Group
Manpower and Personnel Research Laboratory

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Technical Director

L. NEALE COSBY
Colonel, IN
Commander

Technical review by

Paul G. Rossmeissl
Hyder Lakhani

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Technical Report 635

The Allocation of Personnel to Military Occupational Specialties

Edward Schmitz and Abraham Nelson

**Submitted by
Curtis Gilroy, Chief
Manpower and Personnel Policy Research Group**

**Approved as technically adequate
and submitted for publication by
Joyce L. Shields, Director
Manpower and Personnel
Research Laboratory**

**U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES
5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600**

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FOREWORD

The Manpower and Personnel Policy Research Group of the Army Research Institute is concerned with developing more effective techniques for assigning applicants to Army jobs, in order to utilize scarce Army personnel resources more efficiently and effectively. The research discussed in this report examines how well the Army allocates personnel to military occupational specialties, and seeks to find where improvements to the current allocation system may be made.



EDGAR M. JOHNSON
Technical Director

THE ALLOCATION OF ARMY PERSONNEL TO MOS

EXECUTIVE SUMMARY

Objective:

The objective of this research was to evaluate the efficiency of recent Army experience in allocating new personnel to military occupational specialties, and the impact of alternative allocation policies on predicted performance.

Procedure:

The allocation of accessions to groups of MOS during 4 months of FY81 was analyzed using current predictor score information. A personnel allocation model was developed and an optimal allocation of accessions was estimated for each month.

Findings:

The use of an optimization model for allocating accessions to MOS produced a .3 standard deviation increase (6 points) in the aptitude area scores and a .2 standard deviation increase (4 points) in the predicted Skills Qualification Tests performance.

Utilization of Findings:

The investigation of recent Army data indicates substantial improvement is possible. Both USAREC and MILPERCEN should investigate the use of an optimization model to determine the priorities for offering MOS to accession candidates.

THE ALLOCATION OF ARMY PERSONNEL TO MILITARY OCCUPATIONAL SPECIALTIES

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THE ALLOCATION OF ARMY PERSONNEL TO MILITARY OCCUPATIONAL SPECIALTIES

INTRODUCTION

The allocation of individuals to military occupational specialties (MOS) is one of the most important personnel decisions made by the Army. Each year the Army enlists over 100,000 nonprior-service accessions who are allocated to over 250 different military occupational specialties. Currently, individuals are guaranteed training in a specific MOS at the time of their enlistment. This policy is unique to the Army. The Air Force generally withholds assignment to a specific military skill until after basic training has been completed. The Navy will guarantee assignment to a general area (e.g., electronics), but not to a specific specialty within that area.

Allocation to MOS is a critical aspect of an individual's military career. This allocation determines what kind of training individuals will receive, what kind of unit they will be assigned to, and what types of tasks and duties they will perform. Allocation is one of the key factors in determining how well the soldier will be satisfied with the Army and how well he or she is likely to perform. Improper person-MOS matches may result in ineffective and expensive training, extensive retraining, high attrition, poor performance, and less likelihood of reenlistment. Hence, it is to the Army's advantage and to the individual's as well to seek the best possible match between the Army's personnel needs and the individual's skills and abilities.

This research investigates the Army's policies of allocating MOS to accessions. Further, alternative allocation policies are investigated to determine whether significant improvements in predicted performance are possible.

BACKGROUND

The Army currently uses nine composites computed from the Armed Services Vocational Aptitude Battery (ASVAB) to determine the training MOS for a nonprior-service accession (Maier, 1981). Current policy is to use these composites only for determining minimum qualifying score on the proper aptitude area composite. The individual may then train for that MOS, provided a training seat is available. These policies were developed in the all-volunteer era primarily in response to the need to satisfy enlistment quotas rather than by the desire to maximize the performance potential of recruits.

The terms "allocation," "assignment," and "classification" are frequently used in personnel decision making and are distinguished in the present research. Operational definitions are hereby provided. "Assignment" refers to the matching of a specific individual to a specific job, or in the case of the Army, to a specific MOS in a specific unit. "Allocation" refers to the matching of either a specific individual or groups of individuals with an MOS or groups of MOS without regard to unit. "Classification" deals with the determination of the differing aptitudes or abilities that qualify an individual for various kinds of work. This analysis deals with individual accessions, but it matches them with MOS groups, not specific assignments. Hence, this research is an investigation of individual personnel allocation policies.

The matching of people to jobs has long been recognized as an area where significant benefits could be obtained from the application of operations research techniques. Kuhn (1955) described how the assignment of individuals to jobs could be structured like a transportation shipping problem, and provided a mathematical formulation of this structure.

Ward, Haney, Hendrix, and Pina (1978) provided a thorough discussion of the military person-MOS match problem and described how personnel characteristics and MOS properties could be evaluated through a predicted payoff array. These researchers discussed achieving an optimal solution for a group of accessions and provided an approach for obtaining near-optimal solutions in the case where individuals must be evaluated in sequence.

ARI has also conducted previous research on several aspects of this problem. Granda and Van Nostrand (1972) investigated the use of operations research models and decision rules for the simulated allocation of individuals. These studies found operations research models to be relatively expensive to use for the size of the allocation problem faced by the Army. Also, the studies produced no valid criterion for relating aptitude scores to predicted performance.

In the fall of 1976 the Army instituted the Skill Qualifications Tests (SQT). There is a separate SQT for most MOS in the Army as well as for each skill level within the MOS. The SQT is designed to provide a means of assessing a soldier's mastery of the skills necessary for that MOS. In addition to providing the Army with information to assess training needs and other operational data, the SQT can be used to measure posttraining performance (Haner & Grafton, 1982).

Maier (1981), and Haner and Grafton (1982) have undertaken the most recent research relating predictor scores to later MOS performance. Maier documented the relationships between aptitude area scores and SQT performance for all aptitude areas, including many different MOS. He also provided results by race and sex. Haner and Grafton have performed similar research on the relationship between aptitude area and SQT scores. While the SQT has been criticized for not comprehensively testing critical MOS tasks, the great majority of NCOs and officers believe it reflects a soldier's ability well (General Accounting Office, 1982). Thus, it is possible to evaluate MOS allocation decisions in terms of predicted job performance.

APPROACH

The approach used in this research was to investigate the operational allocation of nonprior-service accessions to the Army for several recent time periods. The operational or current allocation policies were compared to three alternatives: no allocation policy (random allocation); allocation policies based on aptitude area scores; and allocation policies based on predicted SQT scores.

Individuals were classified by nine aptitude area scores and by sex. MOS were divided into 36 groups, which were defined by a common aptitude area and qualifying score prerequisite. Women were prohibited from entering combat MOS groups. (The Glossary at the end of this report identifies the MOS in each group.)

Four separate months during fiscal year 1981 (FY81) were analyzed (October, January, April, and July) to determine if results were consistent over the year. A 20 percent random sample of accessions was analyzed for each month. This sample size roughly corresponds to the weekly accession flow. Individuals were allocated to the same MOS distribution as the sample.

For example, if the sample of October accessions allocated 479 men to MOS requiring a CO* score 85, then 479 were allocated to MOS requiring a CO of 85 in the experiment.

Individuals entering MOS that do not require a qualifying aptitude area score were excluded from this study. This exclusion amounted to less than 1 percent of all FY81 accessions. The 22 MOS requiring two aptitude area composites were categorized according to their highest qualifying score. These MOS accounted for only 2.7 percent of FY81 accessions.

Allocation policies were evaluated with aptitude area scores and predicted SQT scores as the criteria. Aptitude area scores were taken from the individual's records. Thus, an individual's aptitude for any kind of MOS was known. Table 1 describes the relationships between aptitude area score and SQT score that were obtained from Maier (1982), using the average simple regression line results. (To facilitate comparisons across MOS, Maier transformed SQT within each MOS studied to Army standard scores with a mean of 100 and standard deviation of 20.)

Table 1

Relationship Between Aptitude Area Scores and Predicted SQT Scores

MOS group	SQT score for aptitude area score of 100	Change in SQT score for 10-point change in aptitude area score
CO	100	5
FA	100	5
OF	100	4
SC	100	8
MM	100	9
CL	100	8
GM	100	7
ST	100	7
EL	100	8

Notes. Derived from Maier (1981), Tables 11 and 13. For an explanation of these abbreviations, see the Glossary at the end of this report.

*For an explanation of abbreviations for aptitude areas, see the Glossary at the end of this report.

A random or "no policy" allocation is included for comparison. The random allocation policy was determined by generating random numbers between zero and 1 for each individual. Each individual was assigned to an MOS group based upon the probability that the random number falls within the prespecified range. For example, if 20 percent of accessions were required by CO, then those individuals with random numbers between zero and .2 would be allocated to CO.

Ideally, it would be desirable to have more detailed information than aggregate aptitude relationships. However, results need to be applicable to all MOS. Also, additional performance measures other than SQT performance would be desirable. Nevertheless, SQT is the most valid performance measure presently available for assessing a wide range of MOS (Armor, 1982).

A number of caveats must be offered with this research design. First, restrictions on MOS allocation other than aptitude area score and sex were not included. Such restrictions as citizenship, education, and physical limitations could change allocation distributions. Similarly, the design does not permit the allocation of individuals in different MOS distributions or the selection of different individuals as accessions. It is implicitly assumed that the Army has made the best possible selection decisions. The issue being investigated is simply whether current allocation policies are distributing personnel to MOS in the most effective manner.

FY81 Accessions

Table 2 describes the FY81 nonprior accessions contained in the four samples analyzed. The number of MOS and accessions are listed for each of the MOS groups. (Only 33 of 36 possible groups actually contained accessions.) These figures define the requirements to be filled in the experiments. Accessions were greatest in July and lowest in April. There were also noticeable distributional differences over the 4 months. For example, combat arms accessions (CO and FA groups) were highest in October, while CL requirements were low. Thus, the months sampled experienced fluctuations in the kinds of requirements filled, as well as in the quantity. Additional information on the characteristics of FY81 accessions can be found in Appendix A.

Development of Optimization Models

The manpower allocation problem was formulated as a network flow model. The following equations describe the formulation for maximizing aptitude area scores:

$$\max Z = \sum_i \left(\sum_j A_{ij} X_{ij} \right) \quad (1)$$

subject to:

$$\sum_j X_{ij} = 1 \text{ for each } i = 1, \dots, N \quad (2)$$

$$\sum_i X_{ij} = M_j \text{ for each } j = 1, \dots, 36 \quad (3)$$

Table 2

FY81 Accessions by MOS Qualifying Categories

MOS group	Oct	Jan	Apr	Jul
1. CO85	479	419	294	442
2. CO95	4	-	4	10
3. FA85	137	101	105	106
4. FA00	17	22	28	33
5. ST85	15	12	12	13
6. ST90	38	6	-	3
7. ST95	193	159	159	178
8. ST00	151	96	95	133
9. ST05	18	14	17	31
10. OF85	170	176	154	237
11. OF95	29	12	20	30
12. CL85	1	-	-	-
13. CL90	49	59	25	54
14. CL95	179	208	223	356
15. CL10	1	3	3	3
16. SC90	54	45	44	54
17. SC95	54	45	70	51
18. SC00	3	10	4	-
19. GM80	1	-	-	-
20. GM85	61	53	50	75
21. GM90	3	8	6	4
22. GM95	23	38	32	49
23. MM85	144	98	58	159
24. MM95	13	30	7	19
25. MM00	82	84	52	87
26. EL85	5	3	4	5
27. EL90	51	44	19	71
28. EL95	78	83	103	108
29. EL00	8	10	17	12
30. EL05	15	8	17	23
31. EL10	11	5	9	10
32. EL15	-	6	2	8
33. EL20	3	1	2	4
Total	2,090	1,858	1,635	2,368

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

where

A_{ij} = the aptitude area score of individual i in MOS group j ;

X_{ij} = the allocation of individual i to MOS group j ;

N = the total number of individuals allocated; and

M_j = the total personnel requirement for each MOS group.

Equation 1 describes the objective function of the model, which is to maximize the total allocation value for a group of accessions, with A_{ij} , the individual's aptitude for a particular job, determining the value. Equation 2 defines the constraint that allows each individual to be assigned to only one job. The third equation states that the demand for each MOS group must be met exactly (at the levels specified in Table 2). The total system is in balance, with the number of individuals allocated equal to the total demand of the MOS groups.

A similar set of equations was specified for the SQT maximization model. The constraints (all individuals must be assigned to exactly one job, and all MOS categories demands must be filled) are the same as the above model. The difference is that the value of particular allocations is weighted by predicted SQT scores instead of aptitude area scores.

Since the manpower allocation problems were formulated as network flow models, certain advantages are gained because of the advances in network algorithms that solve these types of problems. These algorithms are orders of magnitude faster than general linear programming algorithms and require considerably less computer core to solve. Furthermore, the fact that these are network models with integer supplies and demands guarantees integer solutions. Moreover, since the flow into an MOS group is bounded by zero and 1, then the solutions will be zeroes or ones. A network code was used to solve the two optimization problems (see Glover, Karney, & Klingman, 1974).

RESULTS

The research provided useful information on both methodology and policy impacts. The following sections describe the computational experience gained in solving large-scale personnel allocation problems, and the effect of different optimization policies on personnel decisions.

Computational Experience

The allocation of 2,000 or more individuals to 36 MOS categories is a large optimization problem. The most important characteristic determining the problem size is the number of feasible allocations, which is a product of the number of individuals and the number of MOS groups minus those allocations (arcs) not possible because of restrictions (gender and aptitude area qualifying scores). Information on the feasible network allocations is given in

Table 3. Restrictions eliminated 35 to 45 percent of the theoretically possible assignments.

Table 3

Feasible Assignments by Month

Month	Number of individuals allocated	Total possible allocations	Total feasible allocations	
			Number	Percentage of total
Oct	2,090	68,970	45,294	65.7
Jan	1,858	61,314	35,976	58.7
Apr	1,635	53,955	33,636	62.3
Jul	2,368	78,144	43,045	55.1

The computational experience with the network code is provided in Table 4. The solution time ranged from 33 to 74 CPU seconds on the IBM 3081 computer. Time was greater for an increased number of arcs and for the SQT optimization problem.

Table 4

Computational Experience

Month	Number of nodes	Number of arcs	CPU time in seconds (AA optimal)	CPU time in seconds (SQT optimal)
Oct	2,126	49,509	51.3	74.0
Jan	1,894	39,930	38.0	55.5
Apr	1,671	36,941	33.0	45.0
Jul	2,404	47,812	43.0	72.0

These solution times illustrate the kinds of technical breakthroughs that have occurred in the last decade. Improvements in computational hardware, software, and mathematical algorithms have made it possible to solve large optimization problems faster and cheaper. For example, a problem which Granda and Van Nostrand estimated would take 17,000 seconds (4.7 hours) of computer time to solve requires only 38 seconds with the network code.

This 500-fold increase in computational speed indicates that many previously unsolvable allocation problems can be solved today on a regular basis, perhaps even interactively.

Comparison of Allocation Policies

Table 5 presents the aptitude area optimization results by MOS group and month. Optimal allocations have very high average aptitude scores, ranging from 105 to nearly 120 over the time period analyzed. The MOS groups do not exhibit any regular patterns as to which have the highest or lowest aptitude area scores.

Table 5

Optimal Aptitude Area Scores by MOS Group

MOS group	Oct	Jan	Apr	Jul
CO	115.3	109.2	109.7	107.8
FA	115.0	105.0	106.9	104.7
ST	110.2	110.8	110.8	110.5
OF	119.6	112.9	112.6	107.8
CL	114.8	109.9	110.3	109.0
SC	112.3	112.1	110.1	110.5
GM	113.9	111.1	107.9	108.7
MM	114.0	109.6	110.4	106.8
EL	110.2	106.0	107.9	107.8
Average	114.3	110.1	110.3	108.8

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

Table 6 presents similar results for predicted SQT scores, based upon the optimal SQT score allocation. Total SQT scores range from 106.4 to 109.5. MM, ST, and EL MOS groups tended to have the highest predicted SQT scores, while OF, FA, and CO tend to have relatively lower SQT scores. These results are consistent with Maier's estimates that indicate the greatest increases in predicted performance are possible in the MM, ST, and EL MOS groups.

Tables 7 and 8 reveal very similar patterns for the aggregate impact of the alternatives. In all cases and for all months the order of policies remains the same. Operational allocation policy improved aptitude area scores from 3.5 to 5.1 points above no allocation (random) policy. However, an optimal allocation policy would have increased aptitude area scores even more--by 5.1 to 6.6 points over actual allocations. The SQT performance scores produced by operational allocation policies were 2.8 to 3.7 points greater than random allocations. Optimal performance allocation would have achieved an additional 3.9 to 4.3 points above what was actually achieved.

The optimal allocation models achieved these increases in two ways. First, the models based allocations on higher predicted SQT performance scores than were used for actual allocations. Tables 9 and 10 indicated that, approximately

60 percent of the time, individuals were allocated optimally on the basis of higher scores than were actually used. However, in 4 to 8 percent of the cases, individuals were optimally allocated using a lower aptitude area score. Optimal allocation was not achieved merely by allocating individuals on the basis of their highest scores.

Table 6

Optimal Predicted SQT Scores by MOS Group

MOS group	Oct	Jan	Apr	Jul
CO	104.0	101.5	102.2	100.4
FA	101.5	99.3	100.4	99.1
ST	107.8	107.8	113.9	114.2
OF	103.0	98.8	98.5	97.9
CL	116.1	110.3	110.5	109.4
SC	117.4	114.9	107.8	107.6
GM	110.3	108.0	105.9	104.6
MM	120.4	117.7	118.9	116.0
EL	114.2	111.0	111.9	110.8
Average	109.5	107.0	107.2	106.4

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

Table 7

Comparison of Allocation Policies for Aptitude Area Scores

Allocation policy	Oct	Jan	Apr	Jul
No policy	102.5	99.4	100.2	98.1
Operational	107.5	102.9	104.0	103.2
Optimal	113.8	109.5	109.8	108.3
Difference between optimal and operational	6.3	6.6	5.8	5.1

Table 8

Comparison of Allocation Policies for Predicted SQT Scores

Allocation policy	Oct	Jan	Apr	Jul
No policy	101.7	99.6	100.2	98.8
Operational	105.2	102.9	103.0	102.5
Optimal	109.5	107.0	107.2	106.4
Difference between optimal and operational	4.3	4.1	4.2	3.9

Table 9

Comparison of Aptitude Area Optimization Policy
with Operational Allocation Policy

Month	Total	Optimal score is greater than operational	Optimal score equals operational	Optimal score is less than operational
Oct	100.0	63.3	33.0	3.7
Jan	100.0	64.4	30.8	4.8
Apr	100.0	67.0	28.5	4.5
Jul	100.0	60.5	36.1	3.4
Average	100.0	63.5	32.5	4.0

The optimization models also tended to exploit the aptitude differential that exists in individuals. Table 11 shows the differences between the actual MOS group aptitude score and a randomly selected (average) aptitude area score. Except for CL, most individuals were allocated based upon an aptitude area score within 5 points of their average score. Table 12 provides equivalent figures for the optimal aptitude area score allocation. The aptitude differential is greater than 7 points in all cases, and averages over 10 points. An optimization model can efficiently exploit the aptitude differentials that exist in a population of individuals.

Table 10

Comparison of SQT Score Optimization Policy with Operational Allocation Policy (Percent)

Month	Total	Optimal score is greater than operational	Optimal score equals operational	Optimal score is less than operational
Oct	100.0	59.6	32.2	8.2
Jan	100.0	60.7	30.7	8.6
Apr	100.0	63.7	27.1	9.2
Jul	100.0	57.7	35.1	7.2
Average	100.0	60.1	31.7	8.2

Table 11

Aptitude Area Score Differences Between Operational MOS Group and Random Group Allocation Policies

MOS group	Oct	Jan	Apr	Jul
CO	4.3	2.2	1.9	3.1
FA	0.6	4.3	3.6	4.8
ST	5.6	3.3	3.2	5.1
OF	6.3	1.4	1.5	0.5
CL	12.7	12.5	8.5	12.0
SC	1.5	3.4	4.0	3.7
GM	1.3	1.9	7.7	2.9
MM	4.1	3.8	4.3	4.6
EL	2.3	5.4	4.2	5.0
Average	5.0	3.5	3.8	5.1

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

Table 12

Aptitude Area Score Differences Between Optimal MOS Group and Random Group Allocation Policies

MOS group	Oct	Jan	Apr	Jul
CO	10.3	7.1	7.0	7.6
FA	8.3	10.5	9.6	11.7
ST	10.1	9.2	7.3	9.7
OF	16.6	10.3	7.0	7.2
CL	15.2	17.3	16.6	16.6
SC	11.2	9.6	9.7	9.9
GM	11.0	9.2	10.5	10.6
MM	10.8	8.4	9.6	8.3
EL	9.5	9.8	9.7	9.6
Average	11.3	10.1	9.6	10.2

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

CONCLUDING REMARKS

The research on the allocation of personnel to MOS groups yielded four major findings:

1. Recent advances in operations research techniques and computation capabilities can solve large optimization problems efficiently.
2. Operational MOS allocation policies can demonstrate a significant quantitative value.
3. Optimal allocation policies can produce substantially greater improvements in the quality of the person-MOS match.
4. Optimal allocation policies can produce significant changes in the distribution of personnel.

Computer technology and operations research methodology have improved dramatically in the years since Granda and Van Nostrand experimented with allocation methods. The 500-fold increase in speed achieved thus far could likely increase many more times. This means that a group of 2,000 individuals could be assigned to MOS optimally in less than 10 seconds of computational time.

The increases in computational speed permit the evaluation of alternatives that would not have been possible a few years ago. For example, it may be possible to compute an optimal MOS allocation for each individual as he meets with the Army guidance counselor. Also, additional restrictions and policy

goals for determining MOS can be considered so that much more desirable solutions can be found.

Operational allocation procedures have resulted in substantial allocation improvements. The use of aptitude area qualifying scores and the availability of differential aptitude information have produced better decisions than could have been achieved otherwise. Aptitude area composites were 4.4 points higher; predicted SQT scores were 3.3 points above what would have occurred if differential classification information were unavailable.

Optimal allocation procedures can produce even greater improvements. These procedures could produce an improvement of .3 standard deviations (6 points) measured by aptitude area score (Table 7), or .2 standard deviations (4 points) measured by predicted SQT scores (Table 8).

What value would these improved scores provide the Army? Limited data exists on the utility of different levels of job performance. Maier (1981) estimated the value of new classification tests through assumptions concerning training cost reductions and their relationship to SQT scores. While the analysis is not rigorous, it provides an indication of how valuable such improvements might be to the Army. For example, his methodologies imply that an optimal allocation policy would reduce training costs by \$164 million annually.

Another approach to estimating the value of improved job performance is by comparisons with other ways to achieve similar gains. There is no direct mechanism for placing a value on the readiness and combat effectiveness generated by increased soldier aptitude. However, the marginal cost of achieving these goals through alternative inputs can be estimated.

For example, Congress, the Department of Defense, and the U.S. Army all recognize the value of having talented people in the Army. Various programs, such as enlistment bonuses and educational benefits, have been created to explicitly reward individuals with above average aptitudes who enlist in the Army. Other implicit costs are associated with recruiter effort and advertising. A recent analysis estimated the incremental cost to recruit an AFQT Category I-III A male at \$8,700 (Armor, 1982).

FY81 accessions included 40 percent AFQT Category I-III A individuals. The increased job aptitude produced by an optimal assignment policy (.3 standard deviations) would have required an accession cohort comprised of 52 percent I-III A. This increase would have cost \$126.3 million to achieve in FY81 through additional recruiting effort and expenditures. Thus, the value of increasing job performance through other means is likely to be substantial.

Different allocation procedures affect the quality distribution across MOS groups. Figure 1 (aptitude area) and Figure 2 (SQT) compare operational versus optimal performance for January 1981. Aptitude area composites improved across all MOS groups. The OF group, which contains MOS such as air defense crewman, was the only group that did not increase substantially. Predicted SQT improvement was not as evenly distributed. The MOS groups of CO, FA, ST, and OF, which included most combat-oriented MOS, remained about the same, while the other five MOS groups showed substantial increases.

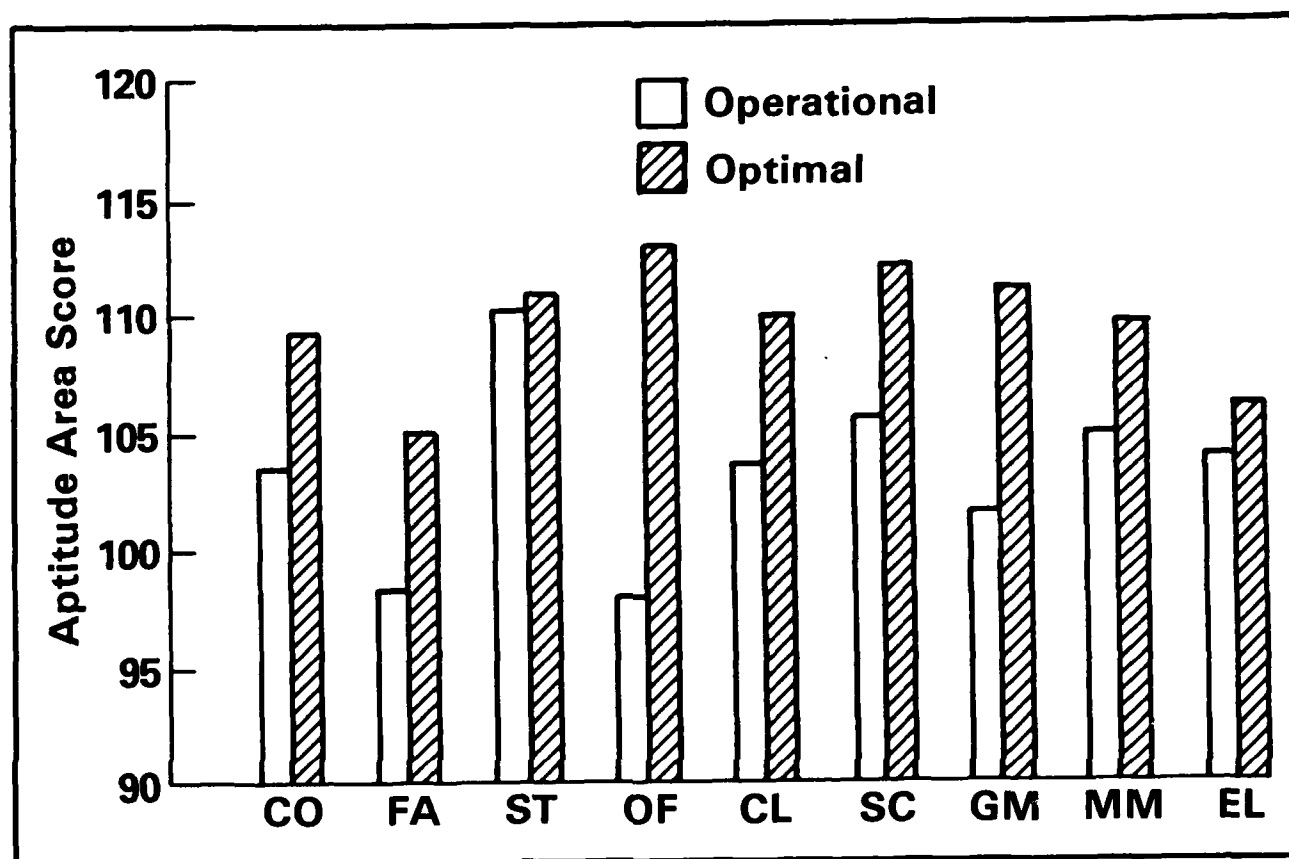


Figure 1. Distribution of optimal and operational area scores.

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

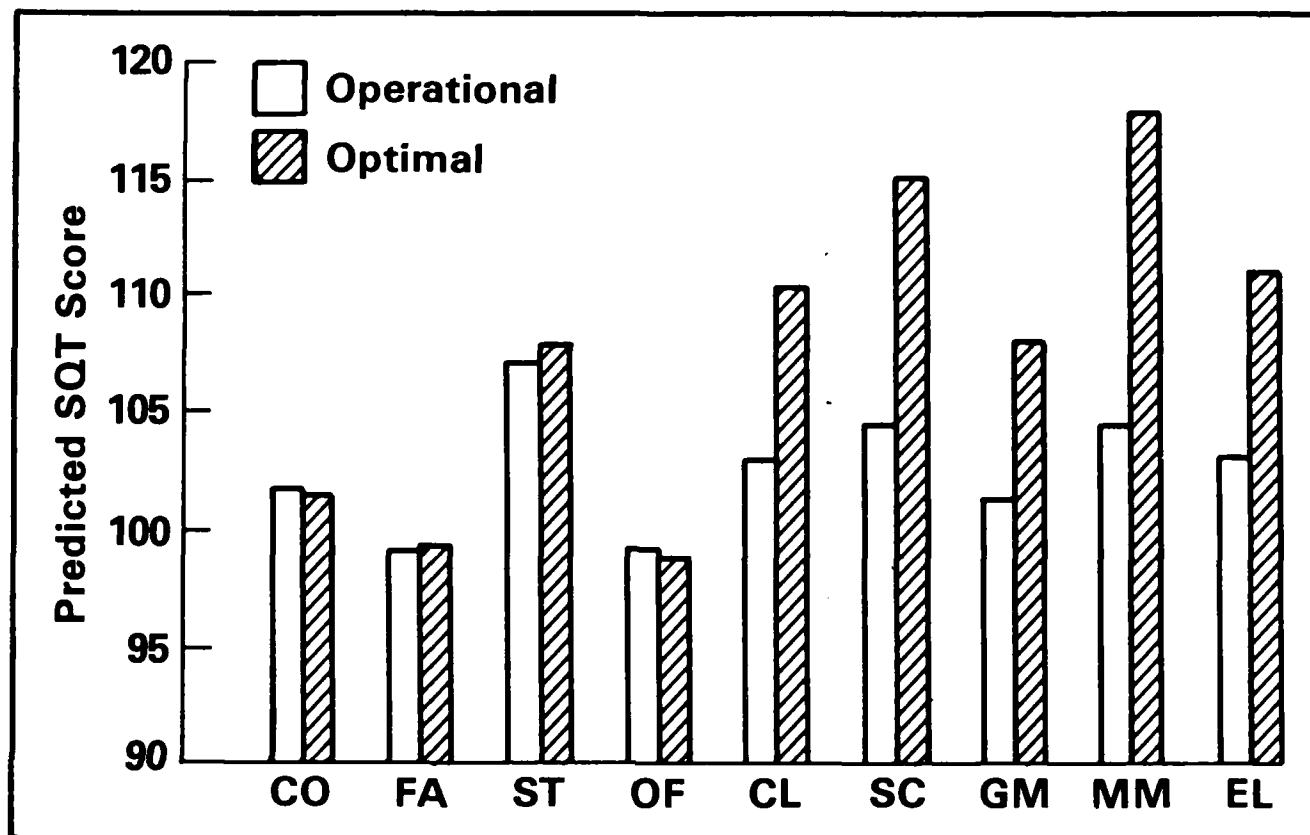


Figure 2. Distribution of optimal and operational SQT scores.

Note. For an explanation of these abbreviations, see the Glossary at the end of this report.

The allocation based on predicted SQT performance was influenced by the fact that relationships between aptitude area composites and predicted SQT performance were weakest for MOS groups in CO, FA, and OF. The methodology therefore places priority on allocating personnel with the highest scores to other MOS groups. Clearly, better predictor/performance relationships are needed most for MOS in CO, FA, and OF, such as infantryman (11B), cannon crewman (13B), and Hercules missile crewmember (16B).

Further, in the SQT performance allocation experiment all MOS groups were weighted equally. It is probably desirable to weight selected MOS, such as combat arms, higher. The value of outstanding performance for a 16S (Stinger crewman) is likely to be greater than for a 57E (laundry and bath specialist).

In summary, the optimization models evaluated indicate that substantial improvements in personnel allocation procedures are possible without additional recruiting effort. Given the same group of accessions and the same group of MOS, it is possible to make significant improvements, either in terms of aptitude area scores or predicted SQT scores.

This does not mean that an optimization policy based upon predicted performance should be pursued exclusively. In today's all-volunteer Army, individuals have the right to choose the MOS they wish to enter. Also, incentives such as VEAP and combat-arms bonuses are likely to increase the quality of CO and FA scores above what might be otherwise predicted. Additional factors, such as difficulty of filling particular MOS, retention, and reenlistment behavior would also need to be taken into account. Nevertheless, even with additional goals and constraints it should be possible to achieve substantial improvements in job performance.

The optimization model test bed also could have a number of other applications to current personnel research. Experiments with new predictor measures can be performed as they are developed. For example, if new predictor data such as the correlation with existing measures is known, a set of simulated predictor scores could be generated for experimentation. Criterion validity ranges could be estimated. More powerful and more general multiple objective performance measures could also be evaluated through simulated experiments on such data.

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GLOSSARY

ENLISTMENT MOS BY APTITUDE AREA AND QUALIFYING SCORE

Qualifying score

MOS

Aptitude area: COMBAT (CO)

85	11B, 11C, 11H, 11M, 11X, 12B, 12F, 19A, 19D, 19E, 19F, 19K
95	12E

Aptitude area: FIELD ARTILLERY (FA)

85	13B
100	13F, 15J

Aptitude area: SKILLED TECHNICAL (ST)

85	03C, 81C, 83E, 83F, 84C, 95C
90	54E
95	05D, 05H, 05K, 13C, 13E, 71P, 81B, 81E, 82B, 82C, 82D, 84B, 84F, 91B, 91C, 91D, 91E, 91F, 91H, 91J, 91L, 91N, 91Q, 91S, 91T, 91U, 91V, 91Y, 92B, 92C, 92D, 93E, 96B, 96C, 96D
100	74D, 74F, 91P, 91R, 93H, 93J, 95B
105	71Q, 71R, 73D, 91G, 97B, 98C, 98J

Aptitude area: OPERATORS/FOOD (OF)

85	16B, 16D, 16F, 16P, 16R, 16S, 64C, 94B
95	15D, 15E, 16C, 16E, 16H, 16J, 94F
100	13M

Qualifying score

MOS

Aptitude Area: CLERICAL (CL)

85	76X
90	76P, 76V, 76W
95	71C, 71G, 71L, 71M, 71N, 73C, 74B, 75B, 75C, 75D, 75E, 76C, 76J, 76Y
100	75F
110	71D

Aptitude area: SURVEILLANCE/COMMUNICATIONS (SC)

90	05B, 72E, 72G
95	05C, 05G, 17C, 17L, 96H
100	13R, 17B

Aptitude area: GENERAL MAINTENANCE (GM)

80	43M, 57E
85	41J, 41K, 43E, 44B, 45B, 51B, 51C, 51K, 51M, 51N, 55B, 57F, 57H, 61F, 62E, 62F, 62H, 62J
90	41C, 45T, 53B, 62G, 68M
95	41B, 42C, 42D, 42E, 44E, 45D, 45G, 45K, 45L, 45R, 51G, 51R, 52C, 52D, 54C, 55G, 68J
100	55D

Aptitude area: MECHANICAL MAINTENANCE (MM)

85	12C, 61B, 62B, 63B, 63H, 63J, 63W
95	33S, 45E, 45N, 63E, 63N
100	61C, 63D, 63G, 63S, 63T, 63Y, 67G, 67H, 67N, 67T, 67U, 67V, 67Y, 68B, 68D, 68F, 68G, 68H

Qualifying score

MOS

Aptitude area: ELECTRONICS (EL)

85	17K, 17M, 25J, 26D, 41G
90	35B, 36C, 36D, 36E, 36K
95	21G, 21L, 22L, 22N, 23N, 23U, 24H, 24K, 24L, 25L, 26B, 26C, 26H, 26M, 26N, 26Q, 26R, 26T, 26V, 27B, 27E, 27F, 27G, 27H, 27N, 31M, 31N, 31V, 32D, 32H, 34B, 34G, 34Y, 35E, 35F, 35K, 41E, 45G, 46N, 52G, 93F
100	26L, 26Y, 32G, 35L, 35M, 35R, 36H
105	24C, 24E, 24G, 24M, 24N, 24P, 24Q, 24U, 31T
110	26E, 26K, 31E, 31J, 32F, 34E, 34F, 34H, 35G, 36L
115	31S
120	35H

APPENDIX A

SELECTED CHARACTERISTICS OF FY81 ACCESSION POPULATION

Table A-1

FY81 Nonprior-Service Accessions by MOS Group

Aptitude area	Qualifying score	Number of MOS	FY81 accessions
CO	85	12	22,042
CO	95	1	158
FA	85	1	5,005
FA	100	2	1,270
ST	85	6	435
ST	90	1	448
ST	95	35	9,270
ST	100	7	6,238
ST	105	7	1,138
OF	85	8	9,838
OF	95	7	1,387
OF	100	1	-
CL	85	1	119
CL	90	3	3,271
CL	95	14	14,735
CL	105	1	-
CL	110	1	189
SC	90	3	2,538
SC	95	5	3,806
SC	100	2	226
GM	80	2	194
GM	85	18	3,491
GM	90	5	504
GM	95	17	2,332
GM	100	1	2
MM	85	7	6,321
MM	95	5	689
MM	100	19	4,826

Table A-1 (Continued)

Aptitude area	Qualifying score	Number of MOS	FY81 accessions
EL	85	5	265
EL	90	5	2,964
EL	95	41	5,523
EL	100	7	608
EL	105	9	903
EL	110	10	511
EL	115	1	91
EL	120	1	113
Total		270	111,450

Note. For an explanation of these abbreviations, see the Glossary.

Table A-2

Percentage of FY81 Accessions by Qualifying Aptitude Area of MOS

Aptitude area of MOS group	FY81 total	Oct	Jan	Apr	Jul
CO	19.9	23.1	22.6	18.2	19.1
FA	5.6	7.4	6.6	8.1	5.9
ST	15.7	19.9	15.4	17.3	15.1
OF	10.1	9.6	10.1	10.6	11.3
CL	16.4	11.0	14.5	15.4	17.4
SC	5.9	5.1	5.4	7.2	4.4
GM	5.9	4.3	5.3	5.4	5.4
MM	10.6	11.4	11.5	7.2	11.2
EL	9.9	8.2	8.6	10.6	10.2
Total	100.0	100.0	100.0	100.0	100.0

Note. For an explanation of these abbreviations, see the Glossary.

Table A-3

Operational Aptitude Area Scores by MOS Group

MOS group	Oct	Jan	Apr	Jul
CO	107.9	103.5	102.9	102.0
FA	100.0	98.2	105.1	100.5
ST	112.9	110.2	107.5	110.6
OF	102.6	98.0	97.3	95.8
CL	106.8	103.6	104.0	103.9
SC	108.9	105.6	105.4	104.5
GM	103.7	101.6	98.0	97.0
MM	108.2	105.0	105.2	104.0
EL	106.6	104.0	107.6	104.9
Average	107.5	103.9	104.0	103.2

Note. For an explanation of these abbreviations, see the Glossary.

Table A-4

Operational Predicted SQT Scores by MOS Group

MOS group	Oct	Jan	Apr	Jul
CO	104.0	101.7	101.5	101.0
FA	100.0	99.1	102.5	100.3
ST	109.0	107.1	105.2	107.4
OF	101.0	99.2	98.9	98.3
CL	105.5	102.9	103.2	103.2
SC	107.1	104.5	104.4	103.6
GM	102.6	101.2	98.6	97.9
MM	107.4	104.5	104.7	103.6
EL	105.3	103.1	106.1	104.0
Average	105.2	102.9	103.0	102.5

Note. For an explanation of these abbreviations, see the Glossary.